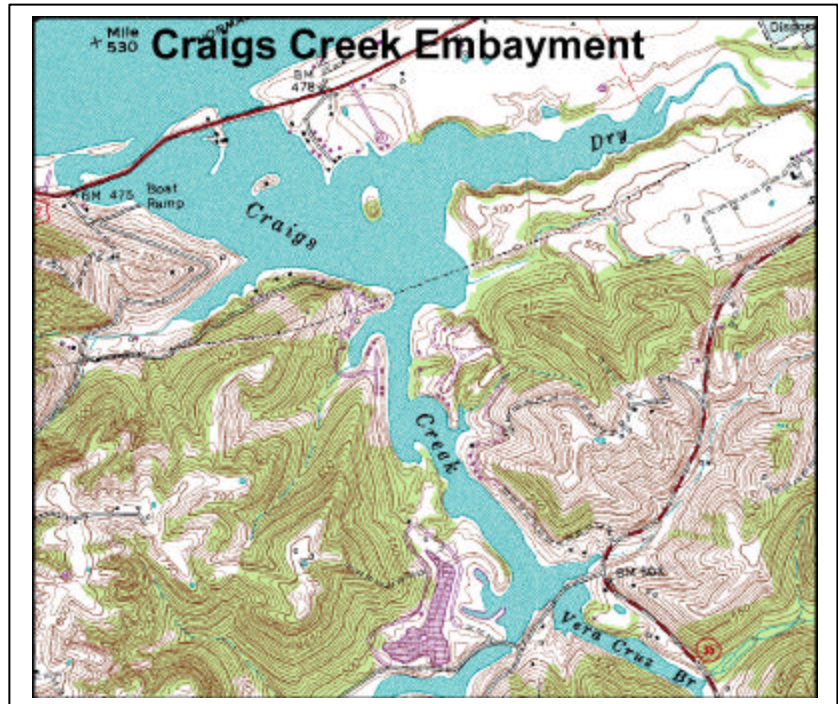


**CRAIGS CREEK EMBAYMENT RESTORATION AND ENHANCEMENT (KY-22)****1.0 Location**

The proposed Craigs Creek Embayment Restoration and Enhancement project area is located in Gallatin County, Kentucky. The embayment is located approximately one mile west of the town of Warsaw, Kentucky. The mouth of Craigs Creek Embayment enters the Ohio River in the Markland Pool at river mile 530.3. The project site is within the Louisville District, U.S. Army Corps of Engineers (USACE).



**Aerial view of a portion of Craigs Creek Embayment**



## 2.0 Project Goal

Ohio River embayments have historically provided important and diverse off-channel habitat for many fish species. Over the years many of the embayments have silted in and no longer maintain the quality or diversity of habitat previously provided.

The primary goal of the Craigs Creek Embayment Restoration project is to restore the aquatic backwater habitat in the embayment. The restoration will provide improved reproductive, feeding, nursery, high water refuge, seasonal migration, and overwintering habitat for fishes in the Ohio River. Enhanced spawning and over-wintering habitat along with increased habitat diversity would improve species diversity, facilitate a sustained fishery resource, and improve the recreational fishery in the area.

## 3.0 Project Description and Rationale

Habitat restoration at the Craigs Creek Embayment site will focus on 1) restoring water depth to the silted in portions of the embayment and 2) creating islands within the embayment.

The shallow upstream areas of Craigs Creek and Dry Run within the embayment will be restored. These shallow portions of the embayment have silted in from sediments deposited from the Ohio River as well as from upstream sources within the watersheds of the creeks. These silted in areas of the embayment will be restored by dredging each area to an approximately 10-12 foot depth in the central portion of each segment of the embayment. The dredging will be at a 3:1 slope resulting in a new channel sloping from the shoreline to approximately 12 feet in depth along the centerline of each area. The overall surface area of the embayment will remain unchanged.

The dredge material will be placed within rock ring dikes placed in three open water areas of the embayment. The ring dikes will be filled with dredge material to form islands within the embayment. The islands will be seeded and forested to limit erosion and create a natural landscape. The creation of islands will provide habitat diversity and spawning habitat for fishes in the area.

## 4.0 Existing Conditions

**Terrestrial/Riparian Habitat:** Most of the shoreline area around Craigs Creek Embayment contains residential development. Some of the lands adjacent to the embayment are undeveloped and contain mixed hardwood forest stands and agricultural areas.



**Development in Craigs Creek**



**Craigs Creek Residential Area**



**Undeveloped Area of Craigs Creek**



**Craigs Creek Marina**

**Aquatic Habitats:** Craigs Creek Embayment is a large embayment. Throughout the main portions of the embayment, under normal pool conditions, water depths are 8 to 12 feet. Shoreline areas throughout much of the embayment are developed, consequently little instream cover is present in the developed areas of the embayment. The upstream portions of the embayment, such as Dry Run and upper Craigs Creek, contain shallow water areas that appear to have become filled with silt and sediments. Some instream cover in the form of log snags and emergent vegetation is present in these shallow water areas of the embayment. Several islands are present in the embayment that provide habitat diversity and additional near shore littoral habitat.

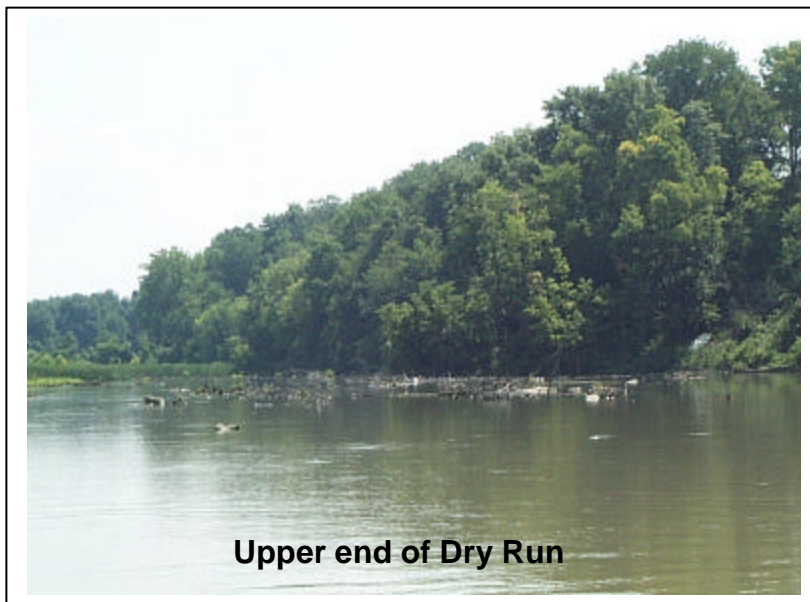


**Upper Craigs Creek Embayment**



**Dry Run Branch of Embayment**

**Wetlands:** Jurisdictional wetland areas within Craigs Creek Embayment are restricted to a narrow riparian band at scattered locations throughout the study area. The Dry Run portion of the embayment contains an area of shallow water emergent wetlands comprised primarily of cattails (*Typha* sp.)



Upper end of Dry Run

**Federally-Listed Threatened and Endangered Species** According to the U.S. Fish and Wildlife Service (USFWS), there are three federally-listed endangered species known to occur in Gallatin County, Kentucky. These species are listed in Table 1.

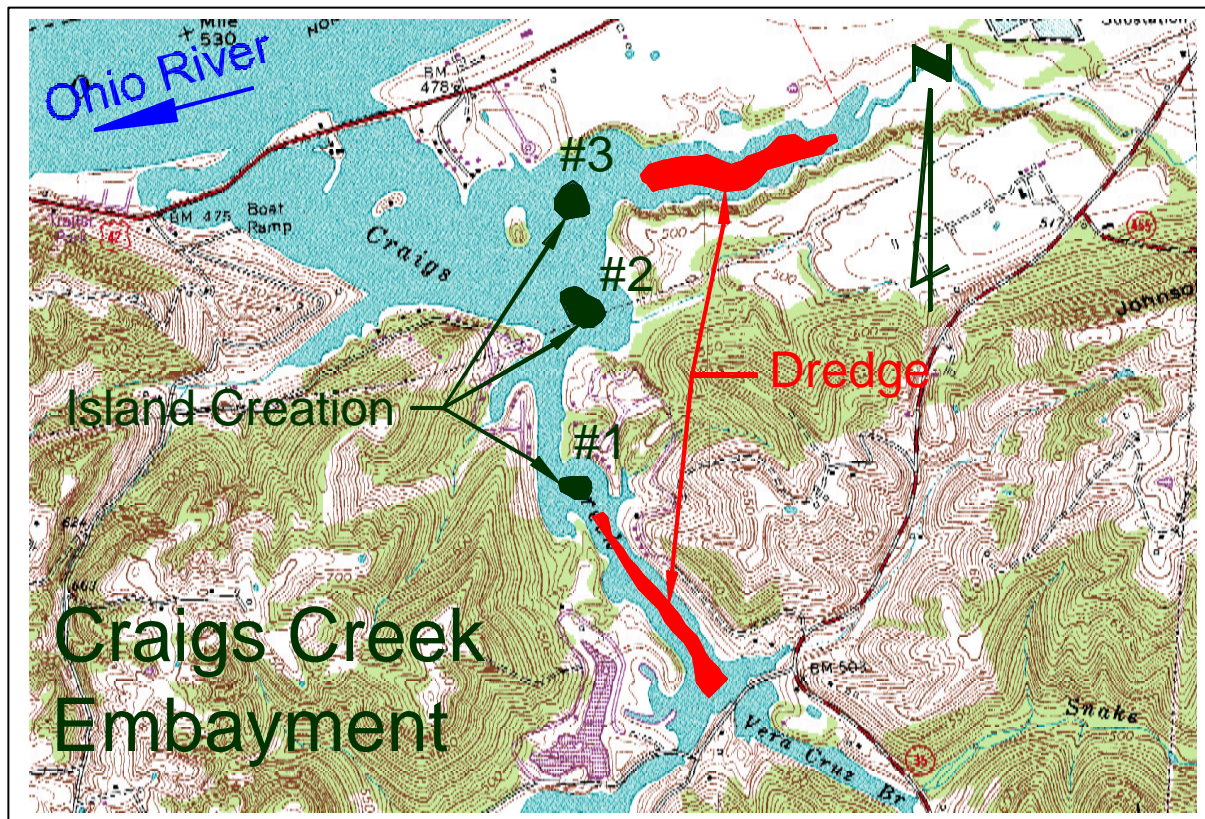
The riparian corridor adjacent to the Ohio River may provide summer roost habitat for the Indiana bat. Preferred tree species would include a mixture of oaks (*Quercus* spp.), silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), and shagbark hickory (*Carya ovata*) (INHS, 1996). The embayment and the riparian corridor would also provide foraging habitat for the Indiana bat.

The white wartyback pearly mussel and the clubshell mussel are both freshwater species. These mussel species are typically found in small to large rivers in substrate that ranges from sand to gravel. There does not appear to be suitable habitat in the project area for these species within the embayment.

**Table 1. Federally-listed species known to occur in Gallatin County, Kentucky.**

Common Name	Scientific Name	Federal Status	Potential Habitat Present
Indiana bat	<i>Myotis sodalis</i>	Endangered	Yes
White wartyback pearly mussel	<i>Plethobasus cicatricosus</i>	Endangered	No
clubshell mussel	<i>Pleurobema clava</i>	Endangered	No
Source: U.S. Fish and Wildlife Service, 1999			

## 5.0 Project Diagram



## 6.0 Engineering Design, Assumptions, and Requirements

### 6.1 Existing Ecological/Engineering Concern

The Craigs Creek embayment has filled with sediments due to several factors. These factors include: raised water levels from the impoundment of the Markland Pool; deposition of Ohio River silt-laden waters, especially during flood events; wave action from barge traffic; and headwater sediments from the Craigs Creek and Dry Creek Run watershed.

### 6.2 Embayment Dredging

#### Craigs Creek Embayment

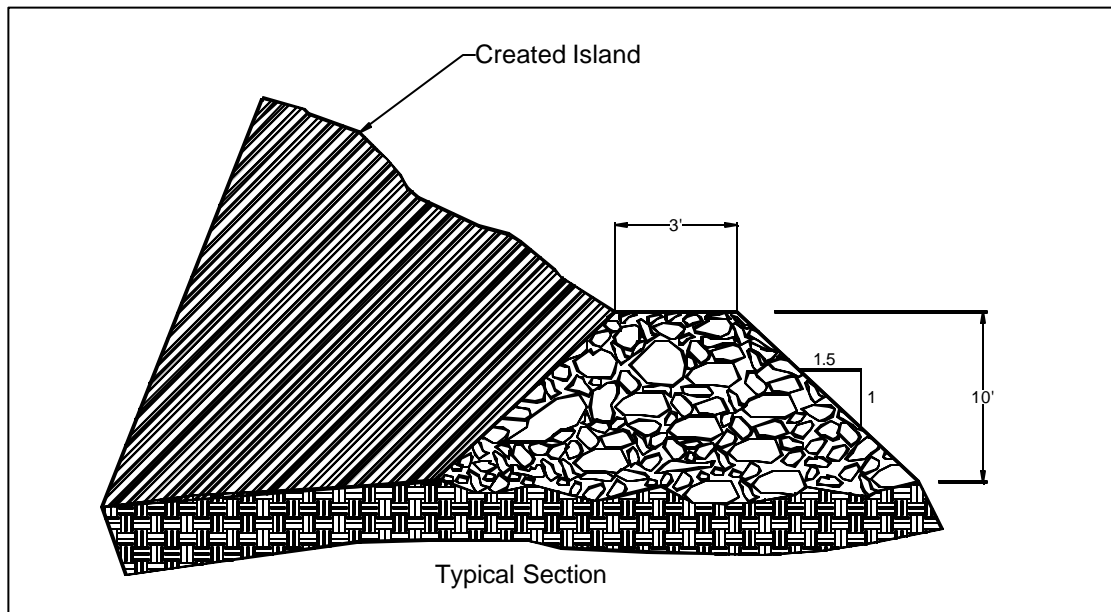
Maintenance dredging of the embayment is required to provide deep water connectivity to the remainder of the embayment and to provide a suitable depth for boater access. An estimated 76,100 cubic yards of silty-clay material would be dredged to restore depths of 9-12 feet in the embayment, with 10:1 side slopes.

#### Dry Creek Embayment

Maintenance of the embayment is required to provide deep water connectivity to the remainder of the embayment and to provide a suitable depth for boater access. An estimated 110,100 cubic yards of silty-clay material would be dredged to restore depths of 9-12 feet, with 10:1 side slopes.

### 6.3 Island Creation

Due to the high density of residential property around the lake, no dredge disposal site is available. Therefore, circular rock dikes, constructed in Craigs Creek Embayment would be used for dredge material disposal. The dredge material would be pumped to the dikes to create islands. The dikes would be constructed of riprap material. They would be 10 feet high, with 1.5:1 side slopes. The ring dikes would be used to contain the material, and provide shoreline protection for the newly created islands.



#### Island #1

- ◆ Perimeter of the island = 1000 feet.
- ◆ Total Area = 1.62 acres.
- ◆ Total Volume of Storage = 39,000 cubic yards.

#### Island #2

- ◆ Perimeter of the island = 1480 feet.
- ◆ Total Area = 3.42 acres.
- ◆ Total Volume of Storage = 82,700 cubic yards.

#### Island #3

- ◆ Perimeter of the island = 1270 feet.
- ◆ Total Area = 2.70 acres.
- ◆ Total Volume of Storage = 62,200 cubic yards.

### 6.4 Planning/Engineering Assumptions

- ◆ A small auger head dredge would be used, and the material would be pumped directly to the disposal site.
- ◆ Bottom side slopes will be reshaped to a 10:1.
- ◆ All the material required for the levee would be taken from on site.
- ◆ A 2,320 gallons per minute (gpm) centrifugal pump would be used for dewatering.
- ◆ Islands will be planted initially with grasses to limit erosion and secondarily with native trees and shrubs appropriate for the island habitat (e.g. various oaks and/or bald cypress). Planting density will be approximately 430 trees per acre.

## 7.0 Cost Estimate (Construction)

**Dredging/Island Creation** - Engineering costs for the proposed project are contained on Table 1. A detailed MCACES cost estimate for the proposed project is included in Appendix D.

<b>Table 2. Engineering Costs.</b>	
<b>Item</b>	<b>Cost</b>
Dredging Craigs Creek	\$95,500
Dredging Dry Creek	\$138,100
Island #1 Ring Dike	\$191,700
Island #2 Ring Dike	\$283,400
Island #3 Ring Dike	\$242,600
Plantings / Vegetation	\$1,800
Mobilization	\$35,000
<b>TOTAL</b>	<b>\$988,100</b>

## 8.0 Schedule

**Embayment Dredging/Island Creation:** The estimated construction time is shown on Table 2.

<b>Table 3. Construction Schedule.</b>	
<b>Item</b>	<b>Cost</b>
Dredging Craigs Creek	80 Days
Dredging Dry Creek	115 Days
Island #1 Ring Dike	5 Days
Island #2 Ring Dike	7 Days
Island #3 Ring Dike	6 Days
Plantings / Vegetation	3 Days
Mobilization	4 Days
<b>TOTAL</b>	<b>220 Days</b>

## 9.0 Expected Ecological Benefits

**Terrestrial/Riparian Habitat:** The impacts of the Craigs Creek Embayment project would be primarily in-stream. There would be no reasonably foreseeable beneficial impacts to terrestrial or riparian resources as a result of implementing the proposed project.

**Aquatic Habitats:** Long-term beneficial impacts to aquatic resources would be anticipated as a result of implementing the proposed project. Restoring depth to the embayment would improve aquatic fishery habitat and provide slack water refuge, nursery, and foraging habitat for riverine fish species. Restoring/increasing the depths of the embayment would provide over-wintering habitat for fishes, especially sport fish such as black basses (Sheaffer, 1986). Island creation will provide habitat diversity and increased littoral spawning habitat. Aquatic habitat for waterfowl species would also be enhanced and the islands would provide nesting habitat for resident Canada geese.. The project would result in an overall improvement of the off channel, slack water aquatic habitat in the area.

**Wetlands:** There would be no reasonably foreseeable beneficial impacts to jurisdictional wetlands as a result of implementing the proposed project.

**Federally-Listed Threatened and Endangered Species:** There would be no reasonably foreseeable beneficial impacts to federally-listed threatened or endangered species as a result of implementing the proposed project.

**Socioeconomic Resources:** There would be short-term and long-term beneficial impacts to socioeconomic resources as a result of implementing the proposed project. The short-term beneficial impacts would be related to costs and local expenditures associated with the dredging and island creation within Craigs Creek Embayment. Long-term socioeconomic benefits would be realized through improved recreational fishing opportunities. Long-term indirect beneficial impacts will be realized through local expenditures for fishing tackle, bait, food, gas, and other associated products.

## 10.0 Potential Adverse Environmental Impacts

**Terrestrial/Riparian Habitat:** There would be minor short-term adverse impacts to terrestrial and riparian resources as a result of implementing the proposed project. Construction related noises and disturbance would cause short-term impacts to terrestrial species in the project area.

**Aquatic Habitats:** There would be a potential for short-term adverse impacts to aquatic resources as a result of implementing the proposed project. Benthic invertebrates and young-of-the-year fishes could be directly disturbed during the dredging activities in the embayment. In addition, sensitive aquatic species within and downstream of the project area could be impacted by increased water turbidity as a result of dredging and island creation activities.

**Wetlands:** There would be no reasonably foreseeable adverse impacts to jurisdictional wetlands as a result of implementing the proposed project. The herbaceous emergent wetlands that populate the portions of Dry Run would be avoided and not disturbed by the dredging operations.

**Federally-Listed Threatened and Endangered Species:** There would be no reasonably foreseeable adverse impacts to federally-listed threatened or endangered species as a result of implementing the proposed project. The riparian areas surrounding the embayment will not be effected by the dredging and island creation process consequently no adverse impacts to Indiana bats would be anticipated. The two endangered mussel species known from Gallatin County are not expected to occur in Craigs Creek Embayment, therefore no adverse impacts to these species will occur.

**Socioeconomic Resources:** There would be no reasonably foreseeable adverse impacts to local socioeconomic resources as a result of implementing the proposed project.

## 11.0 Mitigation

Minor impacts associated with site dredging and spoil placement may occur during the construction of this project, however, no significant adverse impacts are expected. The use of best management practices and proper construction techniques would minimize adverse water quality impacts.

Following the completion of the dredging and island creation, the newly formed islands will be planted in native trees and other vegetation to create a natural landscape. Site improvements such as picnic areas and fishing piers could be developed to provide recreational opportunities at these island sites.

Jurisdictional wetlands present in the Craigs Creek Embayment would not be adversely impacted during the dredging operations, consequently no mitigation would be required.

**12.0 Preliminary Operation and Maintenance Costs:**

Operation and Maintenance costs are summarized on Table 3.

<b>Table 4. Operation and Maintenance Costs</b>		
<b>Maintenance</b>	<b>Frequency</b>	<b>Costs</b>
Maintenance Dredging of Craigs Creek	25 Years	\$ 50,000
Island Maintenance	15 Years	\$ 25,000
<b>TOTAL</b>		<b>\$75,000</b>

**13.0 Potential Cost Share Sponsor(s)**

- ◆ Kentucky Department of Fish and Wildlife Resources
- ◆ The Nature Conservancy
- ◆ Local marinas
- ◆ Local fishing groups
- ◆ Towing industry

**14.0 Expected Life of the Project**

Depending on local management practices within the drainage basin, it is anticipated that the embayment restoration could provide meaningful water depths for fishes for approximately 25-30 years before additional dredging would be necessary.

**15.0 Hazardous, Toxic, and Radiological Waste Considerations**

Potential impacts of hazardous, toxic, and radiological waste (HTRW) at the site were visually assessed during a site visit and further assessed via a database search of HTRW records in the site area.

**Site Inspection Findings**

The project area consist of the backwaters of Craigs Creek about one mile upstream from the mouth of the creek at river mile 530.3 on the Ohio River. The backwater area is in Gallatin County, Kentucky. Warsaw, Kentucky is the nearest town to the project site and is located along the south bank of the Ohio River about two miles northeast of the project site.

The following environmental conditions were considered when conducting the July 14, 1999 project area inspection:

- ◆ Suspicious/Unusual Odors;
- ◆ Discolored Soil;
- ◆ Distressed Vegetation;
- ◆ Dirt/Debris Mounds;
- ◆ Ground Depressions;
- ◆ Oil Staining;
- ◆ Above Ground Storage Tanks (ASTs);
- ◆ Underground Storage Tanks (USTs);
- ◆ Landfills/Wastepiles;
- ◆ Impoundments/Lagoons;
- ◆ Drum/Container Storage;
- ◆ Electrical Transformers;
- ◆ Standpipes/Vent pipes;
- ◆ Surface Water Discharges;
- ◆ Power or Pipelines;
- ◆ Mining/Logging; and
- ◆ Other.

Numerous residential lots and a marina are present in the project area. None of the environmental conditions listed above were observed in the project area.

## Risk Management Data Search

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The search complied with ASTM Standard Practice for Environmental Site Assessments, E 1527-97. This search report is presented in Appendix B. The search report in Appendix B contains two maps showing the area around the project site that was searched for HTRW conditions. As shown on the maps, the database search consisted of a 2 mile radius from the center of the project site. Databases searched and the distance searched from the project site for each environmental item (e.g., USTs, NPL sites, etc.) are as follows:

Databases	Search Radius (Miles)
<b>NPL:</b> National Priority List	2.00
<b>Delisted NPL:</b> Contaminated sites removed from the NPL.	2.00
<b>RCRIS-TSD:</b> Resource Conservation and Recovery Information System	2.00
<b>SHWS:</b> State Hazardous Waste Sites	2.00
<b>CERCLIS:</b> Comprehensive Environmental Response, Compensation, and Liability Information System	2.00
<b>CERC-NFRAP:</b> Comprehensive Environmental Response, Compensation, and Liability Information System	2.00
<b>CORRACTS:</b> Corrective Action Report	2.00
<b>SWF/LF:</b> Available Disposal for Solid Waste in Illinois- Solid Waste Landfills Subject to State Surcharge	2.00
<b>LUST:</b> Leaking Underground Storage Tank	2.00
<b>UST:</b> Underground Storage Tank	2.00
<b>RAATS:</b> RCRA Administrative Tracking System	2.00
<b>RCRIS-SQG:</b> Resource Conservation and Recovery Information System for Small Quantity Generators	2.00
<b>RCRIS-LQG:</b> Resource Conservation and Recovery Information System for Large Quantity Generators	2.00
<b>HMIRS:</b> Hazardous Materials Reporting System	2.00
<b>PADS:</b> PCB Activity Database System	2.00
<b>ERNS:</b> Emergency Response Notification System	2.00
<b>FINDS:</b> Facility Index System/Facility Identification Initiative program Summary Report	2.00
<b>TRIS:</b> Toxic Chemical Release Inventory System	2.00
<b>NPL Lien:</b> NPL Liens	2.00
<b>TSCA:</b> Toxic Substances Control Act	2.00
<b>MLTS:</b> Material Licensing Tracking System	2.00
<b>ROD:</b> Record of Decision	2.00
<b>CONSENT:</b> Superfund (CERCLA) Consent Decrees	2.00
<b>Coal Gas:</b> Former Manufactured gas (Coal Gas) Sites	2.00
<b>MINES:</b> Mines Master Index File	2.00

## HTRW Findings and Conclusions

The database search revealed no HTRW conditions within a one-mile radius of the project area. Two USTs were located approximately two miles from the center of the project area in the town of Warsaw, Kentucky about one mile east of the mouth of Craigs Creek. A power transmission line crosses the creek about 0.75 miles in from the creek mouth on the Ohio River. Another power transmission line crosses the creek about 0.6 miles upstream of point where State Route 1130 crosses the creek.

An inspection of the project site and a search of environmental records relevant to the project site, and extended areas beyond, have revealed no evidence of recognized environmental conditions in connection with this project site.

## 16.0 References

References:	
Scott, 1989	Scott, M.T. and L.A. Nielson. 1989. Young fish distribution in backwaters and main-channel borders of the Kanawha River, West Virginia. <i>Journal of Fisheries Biology</i> No. 35 (Supplement A) pp. 21-27.
Sheaffer, 1986	Sheaffer, W.A. and J.G. Nickum. 1986. Backwater areas as nursery habitats for fishes in Pool 13 of the Upper Mississippi River. <i>Hydrobiology</i> No. 136 pp. 131-140.
Sheehan, 1994	Sheehan, R.J., W.M. Lewis, and L.R. Bodensteiner. 1994. Winter habitat requirements and overwintering of riverine fishes. Fisheries Research Laboratory, Southern Illinois University, Carbondale, Illinois. Final Report F-79-R-6.
USFWS, 1999	U.S. Fish and Wildlife Service, August 5, 1999. Federally Endangered, Threatened and Proposed Species, Kentucky.

**APPENDIX A      Threatened & Endangered Species**

**APPENDIX B            Hazardous Toxic and Radiological Wastes**

**APPENDIX C Plan Formulation and Incremental Analysis Checklist**

**Project Site Location:** The proposed Craigs Creek Embayment Restoration and Enhancement project area is located in Gallatin County, Kentucky. The embayment is located approximately one mile west of the town of Warsaw, Kentucky. The mouth of Craigs Creek Embayment enters the Ohio River in the Markland Pool at river mile 530.3. The project site is within the Louisville District, U.S. Army Corps of Engineers (USACE).

**Description of Plan Selected:** Habitat restoration at the Craigs Creek Embayment site will focus on 1) restoring water depth to the silted in portions of the embayment and 2) creating islands within the embayment.

The silted in portions of the embayment will be restored by dredging. The dredging will be at a 3:1 slope resulting in a new channel sloping from the shoreline to approximately 12 feet in depth along the centerline of each area.

The dredge material will be placed within rock ring dikes placed in three open water areas of the embayment and used to construct islands within the embayment. The islands will be reforested to limit erosion and create a natural landscape.

**Alternatives of the Selected Plan:**

Smaller Size Plans Possible? **Yes** Reduce the amount of dredging and/or dispose of dredge material at a land based site instead of creating islands.

Larger Size Plan Possible? **No**

Other alternatives? **No**

**Restore/Enhance/Protect Terrestrial Habitats?** ☒ Yes **Objective numbers met** ☒ T2

**Restore, Enhance, & Protect Wetlands?** ☐ No **Objective numbers met** ☐

**Restore/Enhance/Protect Aquatic Habitats?** ☒ Yes **Objective numbers met** ☒ A1 & A5

**Type species benefited:** A variety of Ohio River fish species.

**Endangered species benefited:** None

**Can estimated amount of habitat units be determined:** Approximately 22 acres of embayment habitat will be restored. Approximately 8 acres of island habitat will be created.

**Plan acceptable to Resources Agencies?**

**U.S. Fish & Wildlife Service?**

**State Department of Natural Resources?**

**Yes – Kentucky DNR**

**Plan considered complete?**

**Connected to other plans for restoration?**

**Real Estate owned by State Agency?** No **Federal Agency?** No

**Real Estate privately owned?** No

**If privately owned, what is status of future acquisition?** All water based activities, no acquisition required.

**Does this plan contribute significantly to the ecosystem structure or function requiring restoration? What goal or values does it meet in the Ecosystem Restoration Plan?**

Provide habitat diversity, spawning and nursery habitat, and winter velocity shelters for fishes.

**Is this restoration plan a part of restoration projects planned by other agencies? (i.e. North American Waterfowl Management Plan, etc.)**

No

**In agencies opinion is the plan the most cost effective plan that can be implemented at this location?**

**Can this plan be implemented more cost effectively by another agency or institution?**

**Yes / No**

**Who:**

**From an incremental cost basis are there any features in this plan that would make the project more expensive than a typical project of the same nature? For embayment type plans is there excessive haul distance to disposal site? More expensive type disposal? Spoil that requires special handling/disposal?**

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**Potential Project Sponsor:**

**Government Entity:** \_\_\_\_\_

**Non-government Entity** \_\_\_\_\_

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Corps Contractor \_\_\_\_\_ Date \_\_\_\_\_

U.S. Fish & Wildlife Representative \_\_\_\_\_ Date \_\_\_\_\_

State Agency Representative \_\_\_\_\_ Date \_\_\_\_\_

U.S. Army Corps of Engineers Representative \_\_\_\_\_ Date \_\_\_\_\_

## **Terrestrial Habitat Objectives**

- T1     Riparian Corridors
- T2     Islands
- T3     Floodplains
- T4     Other unique habitats (canebrakes, river bluffs, etc.)

## **Wetland Habitat Objectives**

- W1     Forested Wetlands: Bottomland Hardwoods
- W2     Forested Wetlands: Cypress/Tupelo Swamps and other unique forested wetlands
- W3     Scrub/Shrub Emergent Wetlands: isolated from the river except during high water and contiguous (includes scrub/shrub wetlands in embayments and island sloughs)

## **Aquatic Habitat Objectives**

- A1     Backwaters (sloughs, embayments, oxbows, bayous, etc.)
- A2     Riverine submerged and aquatic vegetation
- A3     Sand and gravel bars
- A4     Riffles/Runs (tailwater)
- A5     Pools (deep water, slow velocity, soft substrate)
- A6     Side Channel/Back Channel Habitat
- A7     Fish Passage
- A8     Riparian Enhancement/Protection

**APPENDIX D            Micro Computer-Aided Cost Engineering System (MCACES)**